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Description

Electronically Controlled Sealing Tape Dispenser and Method

Technical Field

The present invention relates to sealing tape dispensers generally and, more particularly, but not by way of limitation, to novel electronically controlled sealing tape dispenser and method of use.

Background Art

Mechanical and electronically controlled sealing tape dispensers are widely used for measuring a selected length of tape, cutting the tape, and also moistening the tape when required. The type of tape used with such machines can be paper, cloth, plastic, reinforced, or combinations of these, for example.

Previously known tape dispensers have certain limitations. For one, the length of tape is typically determined by use of an encoder attached to a motor-driven shaft that presses against one side of the tape, while an idler wheel presses against the other side of the tape. This arrangement is subject to slippage, both when the wheel starts rotating and when power is removed from the motor. The percentage slippage varies with the length of tape being dispensed. Also, the tape cannot be cut instantaneously so the machine commands the tape to be cut before the selected length has been reached. Errors in length can occur because of tape speed variations and the fact that more or less than the amount of expected tape can be dispensed because the tape speed is not factored into the method of determining when to cut the tape. To compensate for these errors, it is common to set the tape dispenser to dispense a length of tape greater than necessary. While

this doesn't usually affect the sealing of a carton, for example, the unnecessary length results in extra cost.

Another limitation is that, although tape dispensers typically have means to add or subtract an increment of length and also have means to double or halve a selected length of tape, conventional tape dispensers have no means to double or halve the increment along with the selected length of tape.

A further limitation of conventional tape dispensers is that, if a length of tape different from the length of tape previously dispensed is desired, it is necessary to press the necessary length selection button(s) to have the second length dispensed. This requires additional time on the part of the operator and also offers the opportunity for the operator to request the wrong length of tape, thus creating unnecessary cost and/or waste. Some machines partially overcome this problem by providing a switch to select one length of tape or another.

Accordingly, it is a principal object of the invention to provide means and method to more accurately measure the length of tape being dispensed from a tape dispenser.

It is a further object of the invention to provide means and method to double or halve an increment of length added to or subtracted from a selected length of tape.

It is an additional object of the invention to provide means and method for automatically dispensing different lengths of tape without having to re-enter desired lengths to be dispensed.

It is another object of the invention to provide such means and method that are economically employed.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the following description and the accompanying drawing figures.

<u>Disclosure of Invention</u>

The present invention achieves the above objects, among others, by providing, in a preferred embodiment, an electronically controlled sealing tape dispenser, comprising: a housing; means disposed in said housing to select a first selected length of sealing tape to be dispensed; means disposed in said housing to dispense said first selected length of sealing tape; and electronic means to control dispensing of said first selected length of sealing tape.

<u>Brief Description of Drawings</u>

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, submitted for purposes of illustration only and not intended to define the scope of the invention, on which:

Figure 1 is an isometric view of an electronic tape dispenser in which the present invention may be employed.

Figure 2 is a fragmentary side elevational view of a conventional tape dispenser.

Figure 3 is a fragmentary side elevational view of a tape dispenser according to the present invention.

Figure 4 is a block diagram of a control system according to the present invention.

Figure 5 is a top plan view of the tape dispenser keypad according to the present invention.

Figure 6 shows the sequence of steps for programming a tape dispenser of the present invention to automatically dispense desired lengths of tape.

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Figure 7 is a block diagram of the control system of Figure 4 operatively connected to a remote host computer.

Figure 8 is a schematic/block diagram showing a plurality of electronic tape dispensing machines operatively connected to the host computer of Figure 7.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawing figures, on which similar or identical elements are given consistent identifying numerals throughout the various figures thereof, and on which parenthetical references to figure numbers direct the reader to the view(s) on which the element(s) being described is (are) best seen, although the element(s) may be seen also on other views.

Figure 1 illustrates an electronically controlled tape dispenser of the type in which the present invention may be employed, the tape dispenser being generally indicated by the reference numeral 20.

Tape dispenser 20 includes a housing 30 having an external keypad 32 that includes a plurality of push buttons, as at 34. Push buttons 34 are used to select tape length to be dispensed from tape dispenser 20 and to perform other functions, as is described more fully below. Tape dispenser 20 further includes a water supply bottle 40, a water heater control 42, a slot 44 through which the tape (not shown) is dispensed, and a water applicator 46 for use when the tape is to be moistened. Electronic control circuitry is disposed within portion 50 of housing 30.

The elements of tape dispenser 20 described above are common both to conventional tape dispensers and to a tape dispenser in which the present invention may be employed.

Figure 2 illustrates the side of a conventional tape dispenser 60 that includes protruding therethrough a drive wheel shaft 62 and an idler wheel shaft 64. As

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shaft 62 is coupled to an electric motor (not shown). To dispense tape 70 from tape dispenser 60, the idler wheel (not shown) mounted on idler wheel shaft 64 is raised by energization of a solenoid (not shown), creating a nip between the idler wheel and the drive wheel (not shown) mounted on drive wheel shaft 62. Rotation of drive wheel shaft 62 thus causes tape 70 to be dispensed from tape dispenser 60. An apertured encoder wheel 80 is mounted to drive wheel shaft 62 to rotate with the drive wheel shaft and an optical sensor 82 detects the rotation of the encoder wheel and provides an output signal representative of the number of rotations of the wheel. This signal is then used to determine the length of tape 70 dispensed. As is noted above, however, slippage occurs between the drive wheel and tape 70, the percentage slippage varying in proportion to the length of the tape dispensed and, thus, the signal does not give an accurate measurement of the length of tape 70 dispensed. Furthermore, error is introduced when tape 70 is cut, as is also noted above.

Figure 3 illustrates the approach of the present invention to overcoming the problem of errors in sensed dispensed tape length. Here, a tape dispenser 60' has a drive wheel shaft 62' and an idler wheel shaft 64', all with the same forms and functions as described above with reference to Figure 2. In this case, however, an apertured encoder wheel 80' is mounted on idler wheel shaft 64'. An optical sensor 82' senses the rotation of idler wheel shaft 64' and provides a much more accurate measurement of the length of tape 70' than does optical sensor 80 (Figure 2), since any movement of the tape will be sensed. Of course, other types of encoder devices may be employed as well.

Figure 4 illustrates a control system according to the present invention, the control system being indicated generally by the reference numeral 100. Control system 100 includes a tape dispensing/cutting

discussed above, and a solenoid 106 that operates a blade to cut the tape. Control system 100 also includes a tape machine controller board 120 that has a microcontroller 122 with memories 124 and 126. Microcontroller 122 is connected to tape dispensing/cutting mechanism 102 through motor control 130 and solenoid control 132. Microcontroller 122 is also connected to an optical tape sensor 140 through a tape sensor interface 142, the optical tape sensor being provided to sense the presence or absence of tape near its exit from the tape machine. Microcontroller 122 is further connected to tape length encoder 80'/82' (Figure 3) through a length encoder interface 150, to keyboard, or keypad, 32 through a keyboard interface 152, and to a foot switch interface 154 that permits the tape machine to dispense tape when a foot switch (not shown) is depressed. A power supply 156 provides electrical power to the various components of control system 100.

Figure 5 illustrates keypad 32 and plurality of push buttons, as at 34. Push buttons 34 that have numerals thereon can be depressed to command tape machine 20 (Figure 1) to dispense tape of a selected length. Push button 160 with "+" thereon adds and increment to the length of tape dispensed, push button 162 with "-" thereon subtracts an increment from the length of tape dispensed, while push button 164 doubles or halves the length of tape dispensed. Whether the length is doubled or halved depends on the length of tape selected, with the lengths of shorter pieces being doubled and the lengths of longer pieces being halved. Push button 170 is used to select an automatic mode, discussed below, and depressing push button 172 will cause the tape machine to dispense tape as long as push button 172 is depressed. Push buttons 180 and 182 recall tape lengths tape previously entered into memory.

The present invention may provide a further method of improving tape length accuracy. In the present case, errors in tape length can be empirically determined.

(Figure 4) and the proper correction length can then be applied by microcontroller 122 for each length of tape selected. The data in memory 124 can take, for example, the form of a lookup table, with interpolation between entries if desired, or it can take, for example, the form of an algorithm for continuously variable correction lengths.

Microcontroller 122 (Figure 4) can also be programmed to double or halve a selected length of tape including any increment of length added to or subtracted from the selected length of tape. Thus, assume that the units on keypad 32 (Figure 5) were in inches and that one wished to dispense a piece of tape having a length of 26 inches. One could then, for example, depress push button "12", then depress push button "+" twice to add two increments of one-half-inch each, and then press push button "2X". Now, when push button "REPEAT/START" is depressed, a piece of tape having a length of 26 inches will be dispensed.

The use of push button 170 and suitable programming of microcontroller 122 can produce automatic dispensing of tape from tape dispenser 20 (Figure 1). Push button 170, "A", or "AUTO" (Figure 5) toggles the tape dispenser between automatic and normal modes. A buzzer can produce an audible beep when entering the automatic mode and when exiting back to normal mode. When the automatic mode is entered, the dispenser is ready to set up a tape sequence. Depressing push button 180, "REPEAT/START" (Figure 5), immediately after entering automatic mode will skip setup and use the last stored sequence. If no sequence is stored, then a default sequence, e.g., repeating four-inch lengths is used.

To set up a length sequence, the user begins by pressing push button 170 (Figure 5) to enter the automatic mode. The user then dispenses up to three pieces of tape of the length and in the order of the desired sequence. Microcontroller 122 (Figure 4) stores

push button 180, "REPEAT/START" (Figure 5), to begin the automatic sequence, at which time the first piece of tape in the sequence is produced. When the first piece of tape is removed, the tape dispenser automatically produces the second piece of tape in the sequence, and so on. The user actions and machine responses shown on Figure 6 indicate the process for setting up the tape dispenser to produce a continuous sequence of alternating 36- and 18-inch lengths of tape.

While the present invention is indicated, for illustrative and practical purposes, as being able to automatically produce up to three different lengths of tape to use, for example, an "H" pattern in sealing a carton, it will be understood that the present invention may be employed to produce any number of different lengths if desired.

Figure 7 illustrates control system 100 operatively connected to a remote host computer, or controller, 200. Host computer may actually provide control inputs for one or more of the functions of tape dispenser 20 and/or it may simply provide bookkeeping functions, such as tracking accumulated lengths of tape dispensed, the numbers of pieces of tape dispensed, the rate of use of the tape dispenser, or other items relating to the use of the tape dispenser. This information can be used, for example, to determine when the roll of tape in tape dispenser 20 requires replacement.

It will be understood that RS-232 driver/receiver transmission protocol may be used when host computer 200 is operatively connected only to tape dispenser 20 and that RS-485 driver/receiver transmission protocol may be used when more than one tape dispenser is operatively connected to the host computer. Transmission may be over hard wired lines or it may be via RF communication means.

Figure 8 illustrates the latter situation noted immediately above in which host computer 200 is

dispensers 300 and 302. Of course, any number of tape dispensers may be operatively connected to host computer 200.

In the embodiments of the present invention described above, it will be recognized that individual elements and/or features thereof are not necessarily limited to a particular embodiment but, where applicable, are interchangeable and can be used in any selected embodiment even though such may not be specifically shown.

Terms such as "upper", "lower", "inner", "outer", "inwardly", "outwardly", and the like, when used herein, refer to the positions of the respective elements shown on the accompanying drawing figures and the present invention is not necessarily limited to such positions.

It will thus be seen that the objects set forth above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction and/or method without departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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